Space Weather Technical Forecast

Issued on Friday, 16 September 2022 at 01:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of a G1/Minor geomagnetic storm. Chance of R1/R2, but risk falling later in weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low over the past 24 hours, mainly at low level C-class activity. The largest flare was a long duration C6 flare at 15/0633 UTC. This appears to have been associated with a filament eruption in the southwest quadrant. An associated CME was emitted, which is likely to have an Earth directed component, with confirmation awaited from a model run.

There are four regions on the visible disc, with AR3098 the largest and most complex, appearing as an Esc/Beta-Gamma, with an apparent reduction in area perhaps due in part to nearing the limb, but also due to fading intermediate spots. There are two other groups of note, both with large spans but relatively unpopulated centres, giving lower probabilities of flares and simpler designations - AR3100 faded a little in the period, while AR3102 saw little change. Recently numbered AR3103 continues to grow in the period, becoming a Cri/beta.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was at slow ambient levels throughout, generally close to 330 km/s, after the previous day's CME arrival. The solar wind density was mainly at average levels, occasionally slightly above and also slightly below, peaking at 14ppcc at 15/0052 UTC. The IMF started the day peaking at 16 nT, then gradually declined to end the day at 11 nT. The north-south component of the magnetic field was positive throughout. The Phi angle was positive, then switched to become negative after approximately 15/1317 UTC. The resulting geomagnetic activity was initially Active (Kp 4) but quickly decreased to become Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16, was initially slightly elevated, but then declined to reach background levels.
Electron flux was Low to Moderate, peaking at 587 pfu at 15/0025UTC. The corresponding 24-hour electron fluence was initially above the Active threshold, (1e8 integrated pfu), but then quickly declined. At 16/0001UTC the observed fluence value was 1.1e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain predominantly at Low levels, with a chance of M-Class flares, today and tomorrow. Thereafter solar activity is expected to decline, as AR3098 rotates off the Earth-facing disc. No notable regions are due over the limb to compensate.

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Solar Wind / Geomagnetic Activity: After starting at background speeds the solar wind is expected to become enhanced later today or early tomorrow, due to the arrival of a HSS from coronal hole 23. This means the geomagnetic activity will be Quiet to Unsettled (Kp 1-3) today, then increasing Unsettled to Active (Kp 3-4) overnight with a chance of a G1/Minor geomagnetic storm (Kp 5). From day 3 (18th) geomagnetic activity is excepted to decline to Quiet levels (Kp 0-2).

Energetic Particles / Solar Radiation: There is a Slight Chance of S1, mainly today and tomorrow, before AR3098 rotates off the visible disc.
The high energy electron flux (greater than 2MeV) is expected to start at background to moderate levels, then probably increasing to High levels after the arrival of the HSS, with this possible from day three (18th). The corresponding electron fluence is expected to increase later in the period, and is likely to reach Active levels (1e8 integrated pfu) during day 4 (19th).

Figure 1. Solar Analysis Valid 15/1915 UTC.

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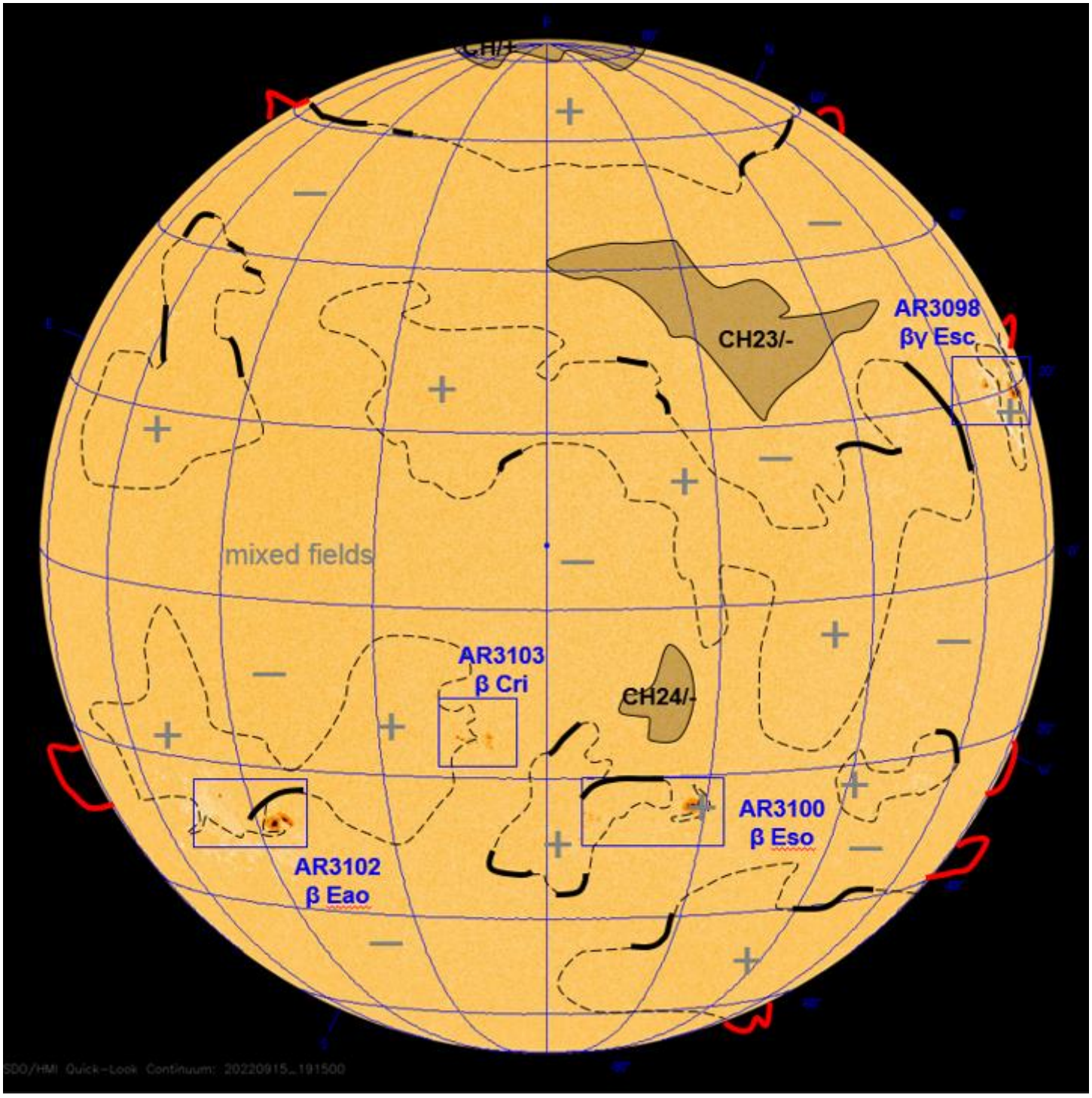
Met Office Space Weather Technical Forecast



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

After starting at background speeds the solar wind is expected to become enhanced later today or early tomorrow, due to the arrival of a HSS from coronal hole 23. This feature is a recurring coronal hole, which on the past rotation produced a G1/Minor storm, although the HSS arrived quicker.
Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) today, then increasing Unsettled to Active (Kp 3-4) overnight with a chance of a G1/Minor geomagnetic storm (Kp 5). From day 3 (18th) geomagnetic activity is excepted to decline to Quiet levels (Kp 0-2). However, the CME from the filament eruption on the 15th may have an Earth directed component, and is most likely to arrive on day 3 (18th). If this occurs then geomagnetic activity is likely to remain Unsettled to Active with a chance of a G1/Minor geomagnetic storm.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	40	30	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

There are four regions on the visible disc, with AR3098 the largest and most complex, appearing as an Esc/Beta-Gamma, with an apparent reduction in area perhaps due in part to approaching the limb, but also due to fading intermediate spots. There are two other groups of note, AR3100 and AR3102, both with large spans but relatively unpopulated centres, giving lower probabilities of flares and simpler designations, especially as they appear stable. Recently numbered AR3103 continues to grow in the period, becoming a Cri/beta.
Solar activity is expected to remain predominantly at Low levels, with a chance of M-Class flares, today and tomorrow. Thereafter solar activity is expected to decline, as AR3098 rotates off the Earth-facing disc. No notable regions are due to rotate onto the visible disc to compensate.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	15	5
Very Active	R3 to R5 X Class	No	5	5	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) is currently at background levels. There is a Slight Chance of S1, mainly today and tomorrow, before AR3098 rotates off the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	15	5	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is expected to start at background to moderate levels, then probably increasing to High levels after the arrival of the HSS, with this possible from day three (18th) if the CME from the filament eruption on the 15th misses Earth. The corresponding electron fluence is expected to increase later in the period, and is likely to reach Active levels (1e8 integrated pfu) during day 4 (19th), which happened on the previous rotation.
The Met Office REFM model is considered to be offering poor guidance initially, with a continued downward trend in the fluence expected. Later in the period the forecast upwards trend is currently accepted.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)

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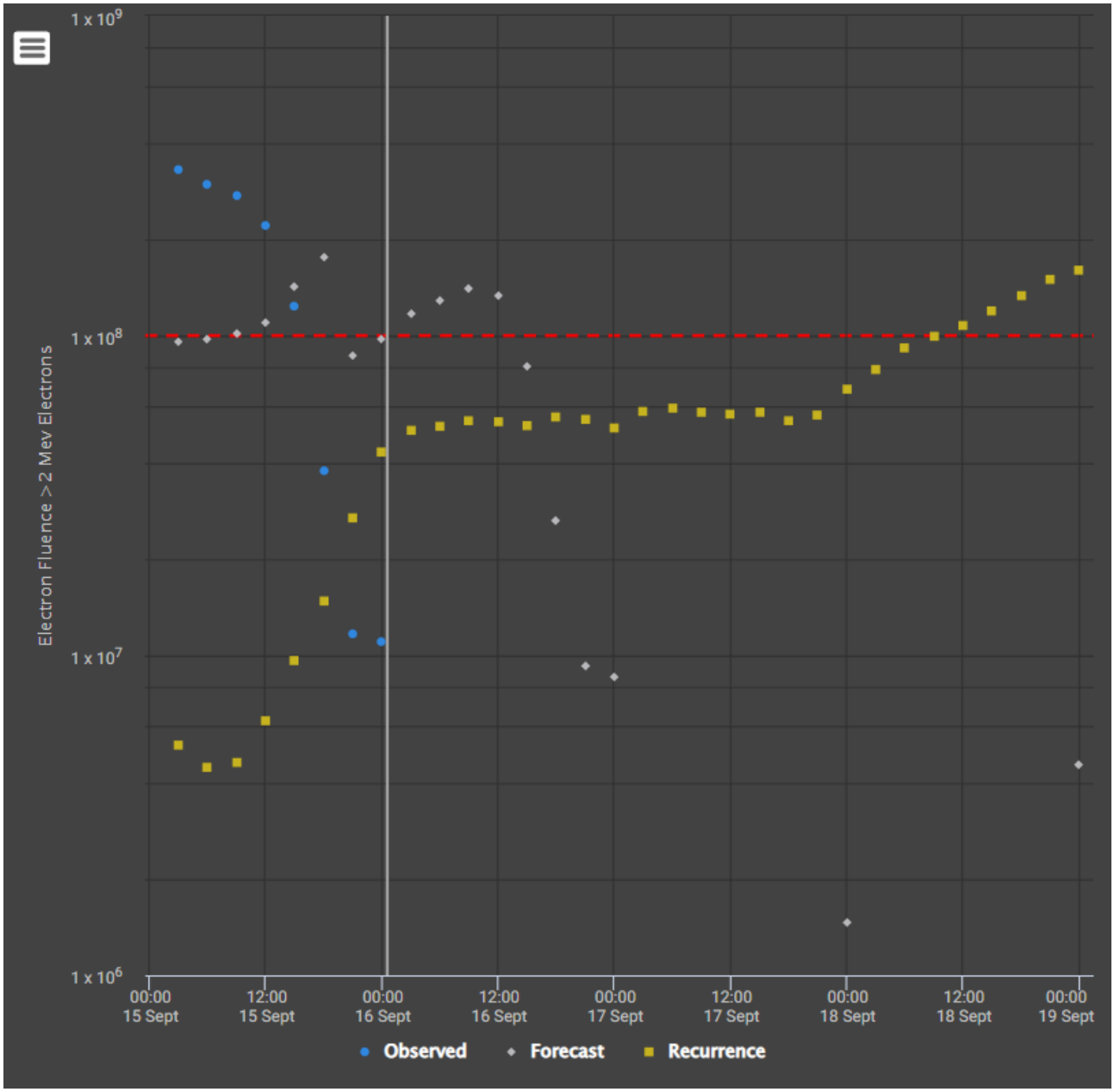
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	20	20	40	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: Met Office REFM model



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